

BATSE – The History and Legacy

Gerald J. (Jerry) Fishman

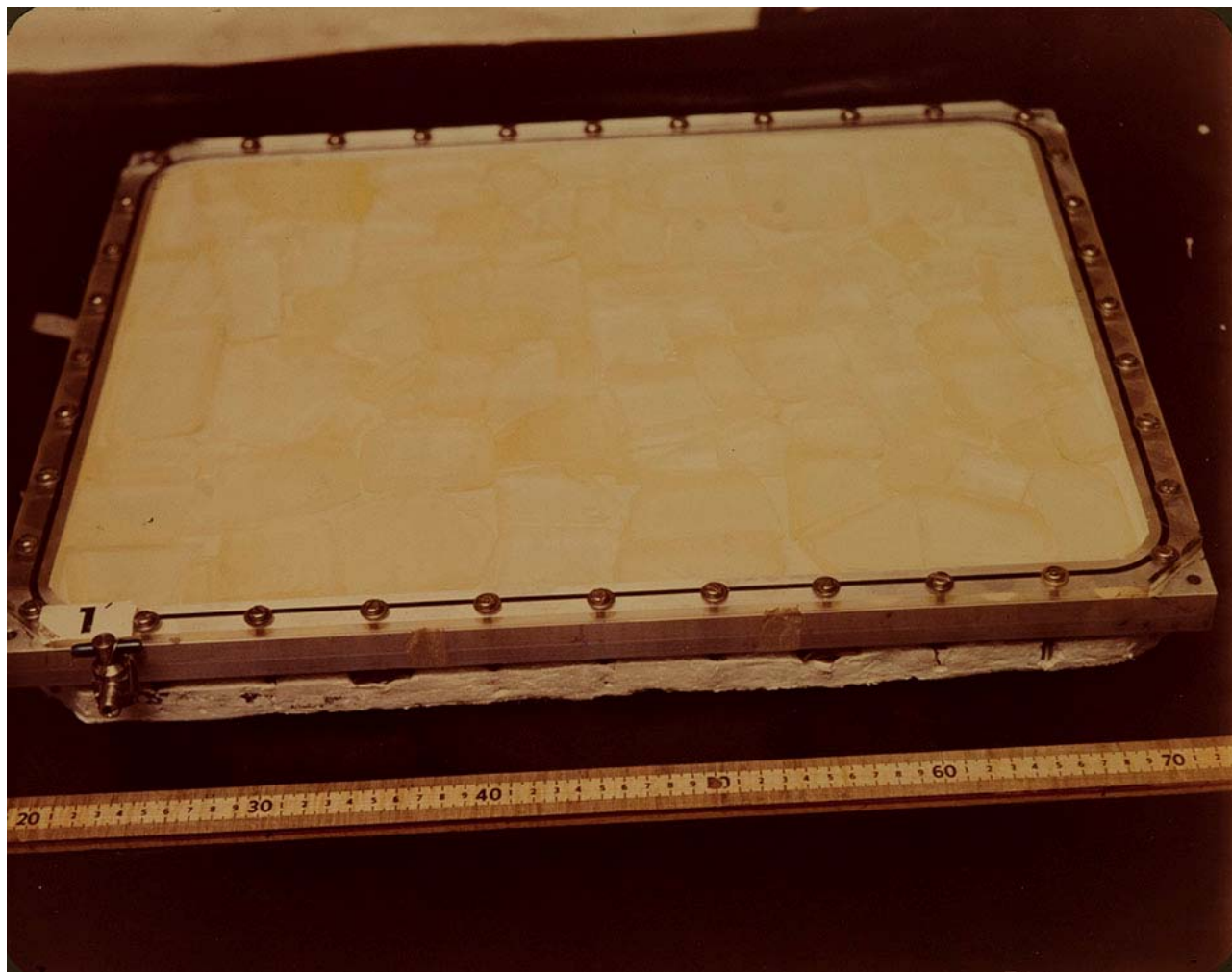
NASA - Marshall Space Flight Center
Huntsville, USA

*GRB 2012, Munich, Germany
May, 2012*

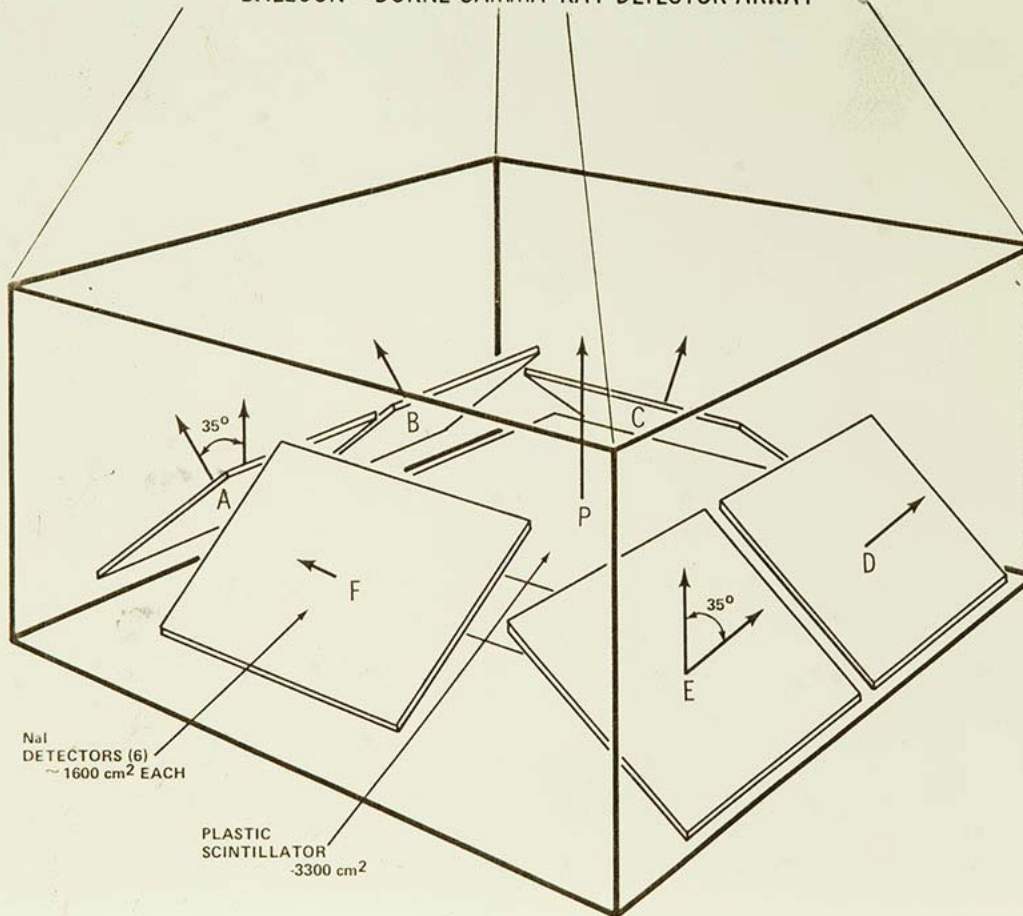
Detector Development & Early Balloon Flights

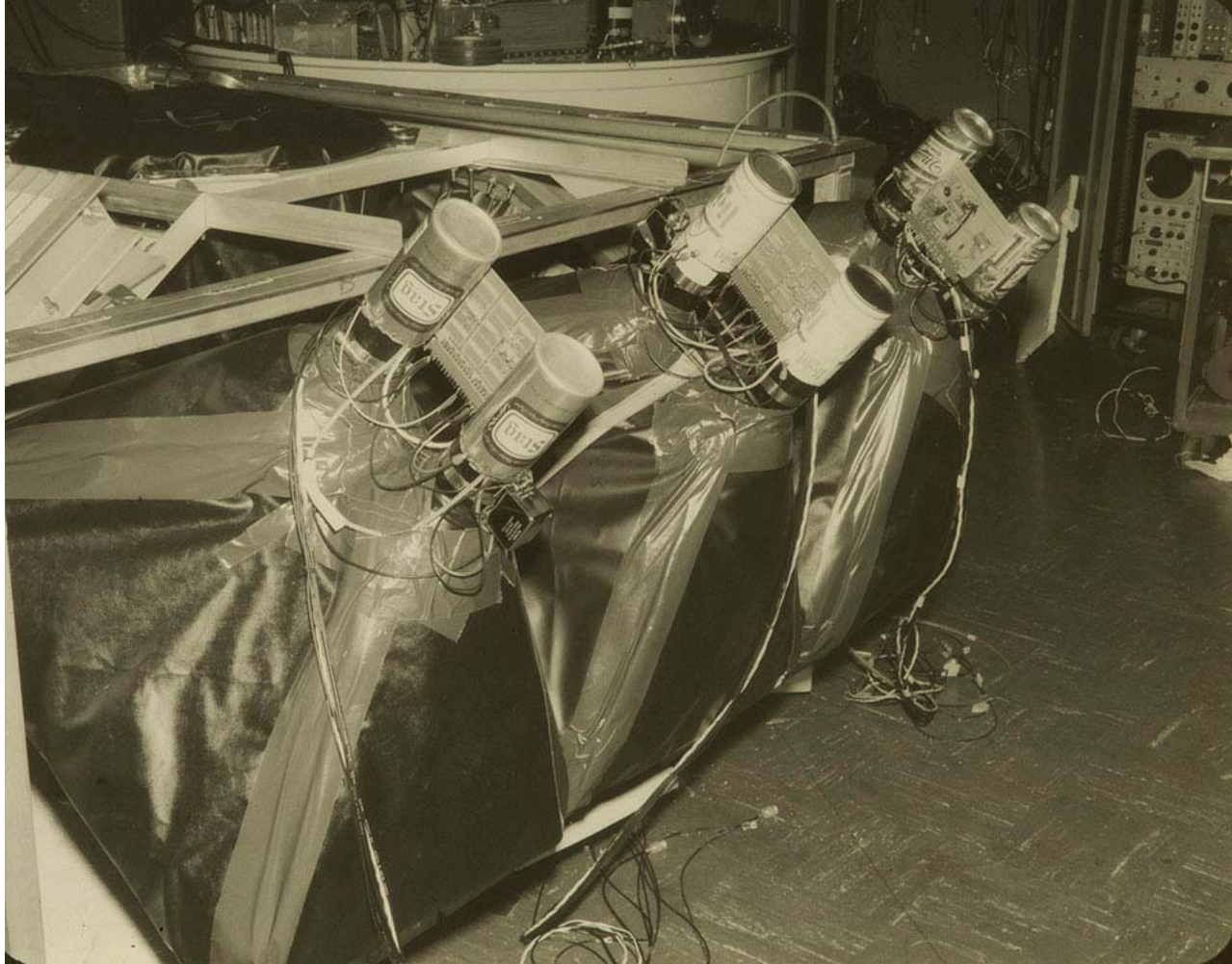
1975-1980





BALLOON - BORNE GAMMA-RAY DETECTOR ARRAY





**Proposing for BATSE;
Negotiating after Approval**

GAMMA-RAY OBSERVATORY

CONCEPTUAL DESIGN

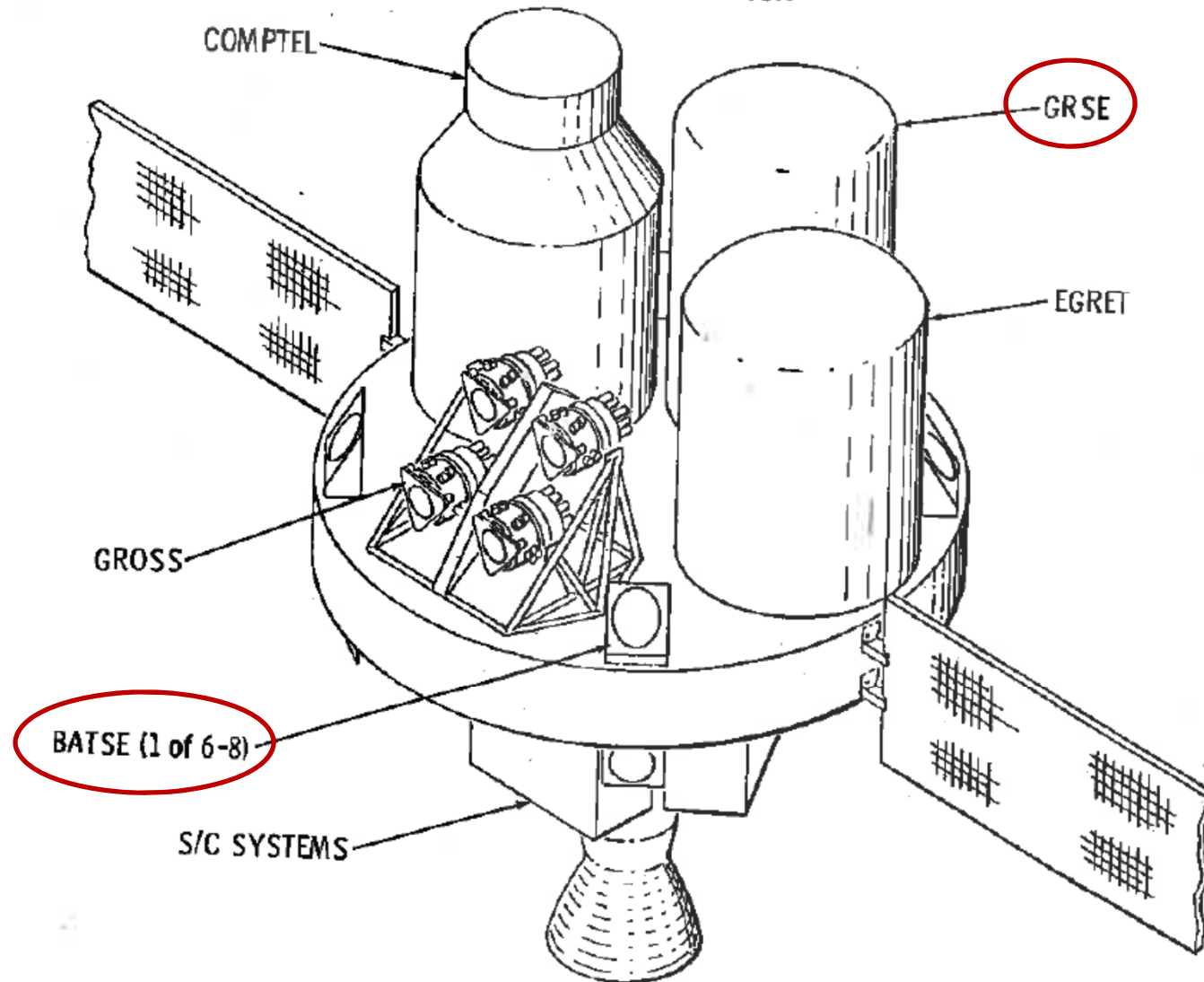
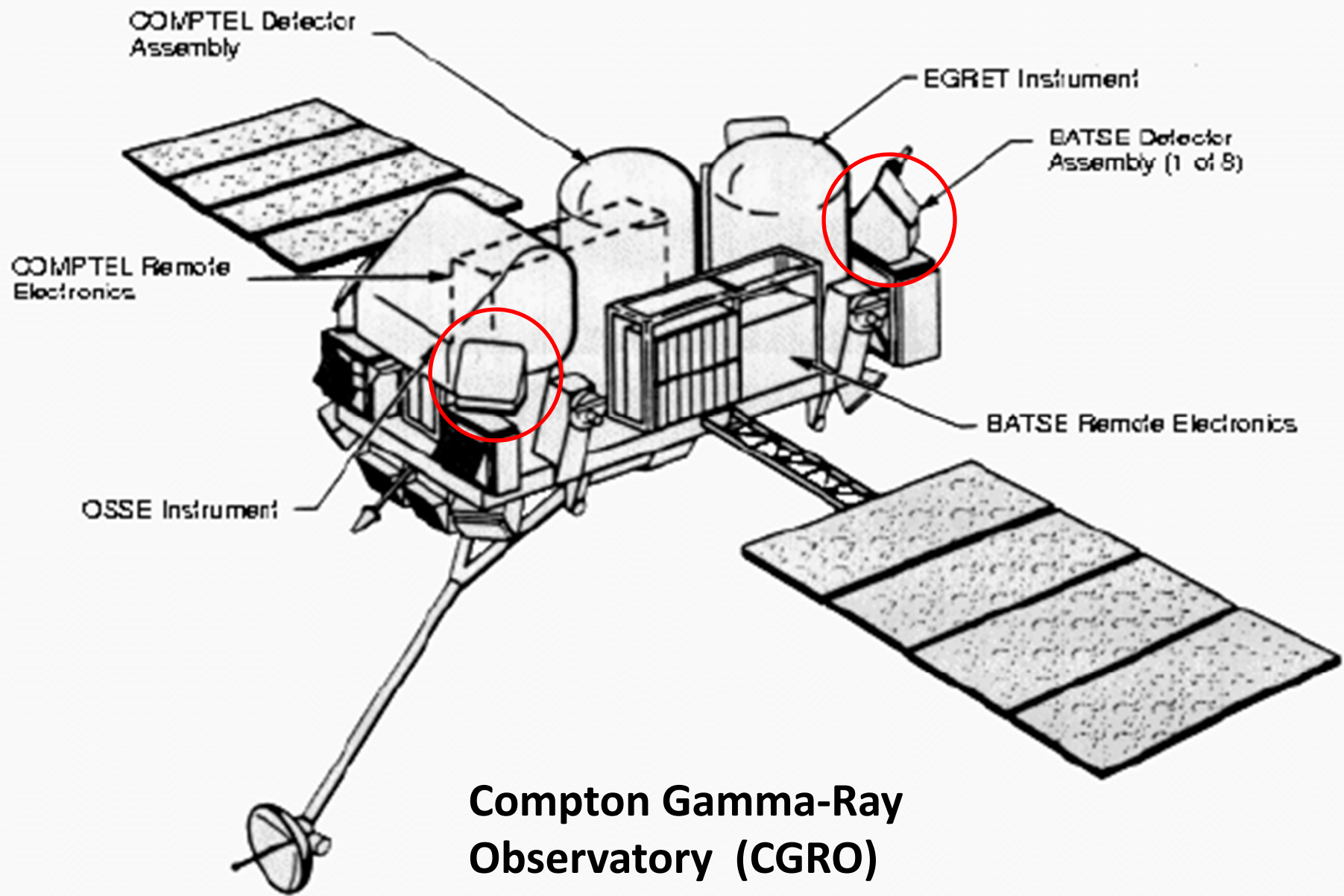


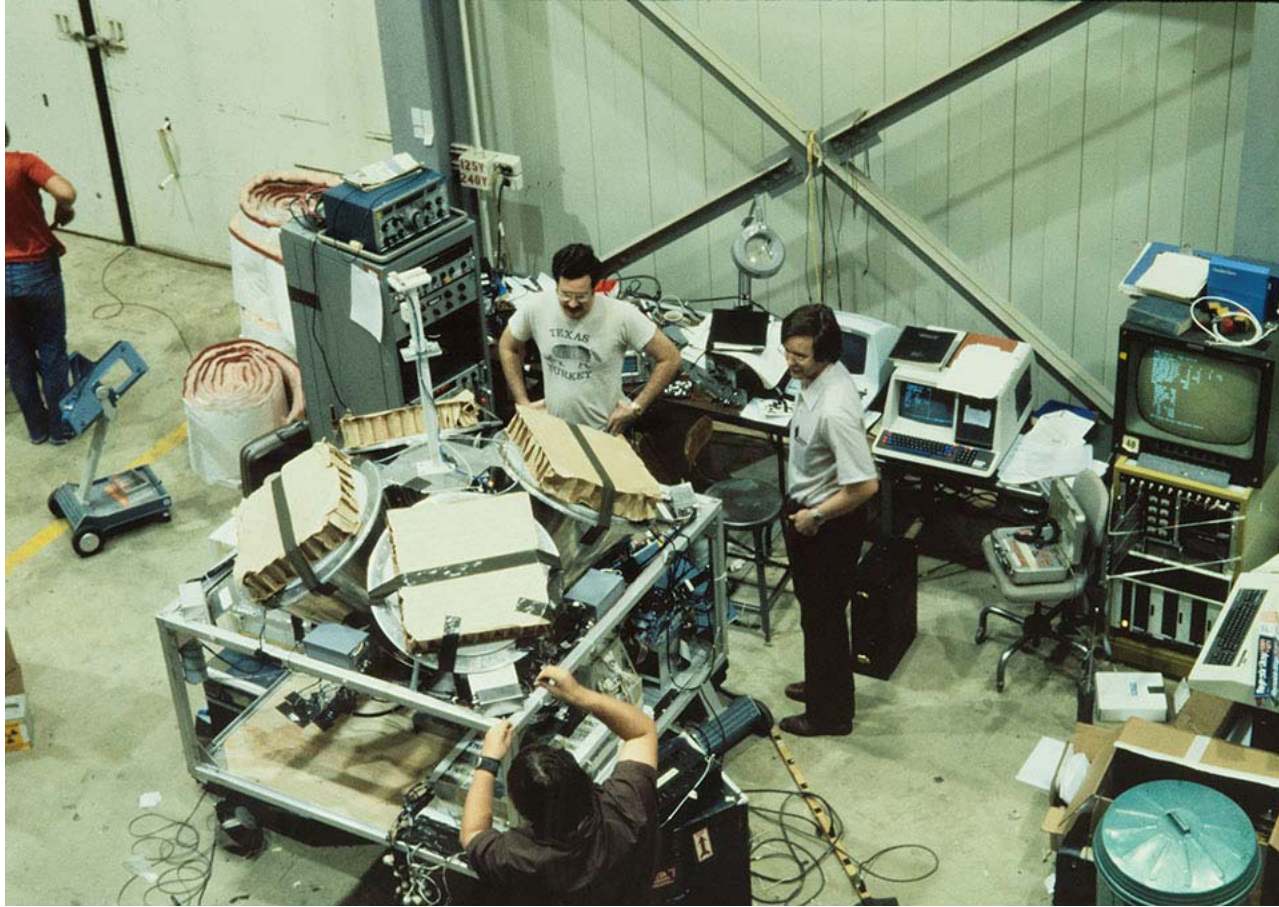
Fig. 3. Conceptual drawing of the planned Gamma-Ray Observatory (GRO) showing the four major pointed experiments and a possible configuration for the BATSE array.

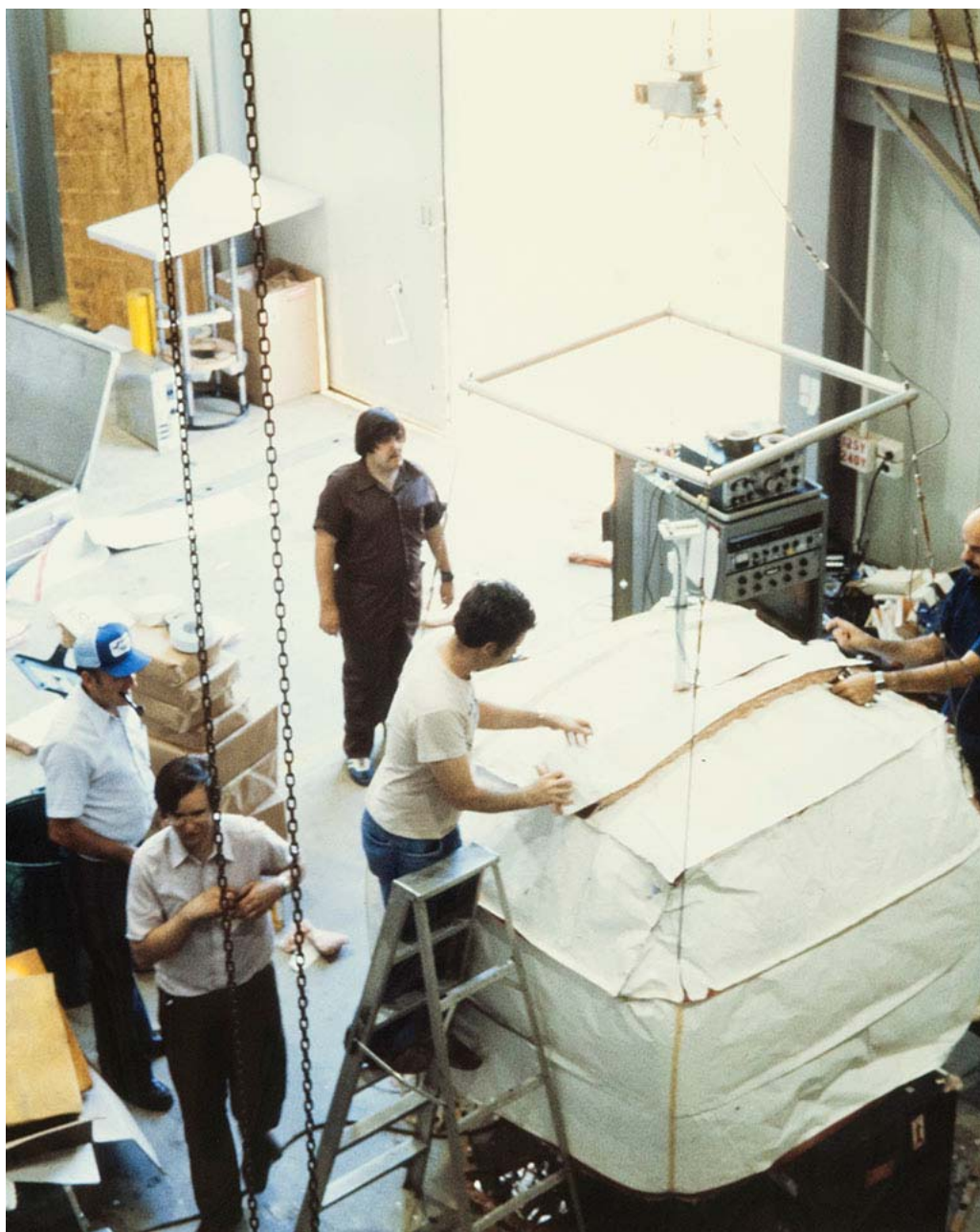


BATSE Detector Development & Balloon Flights

1980 - 1987





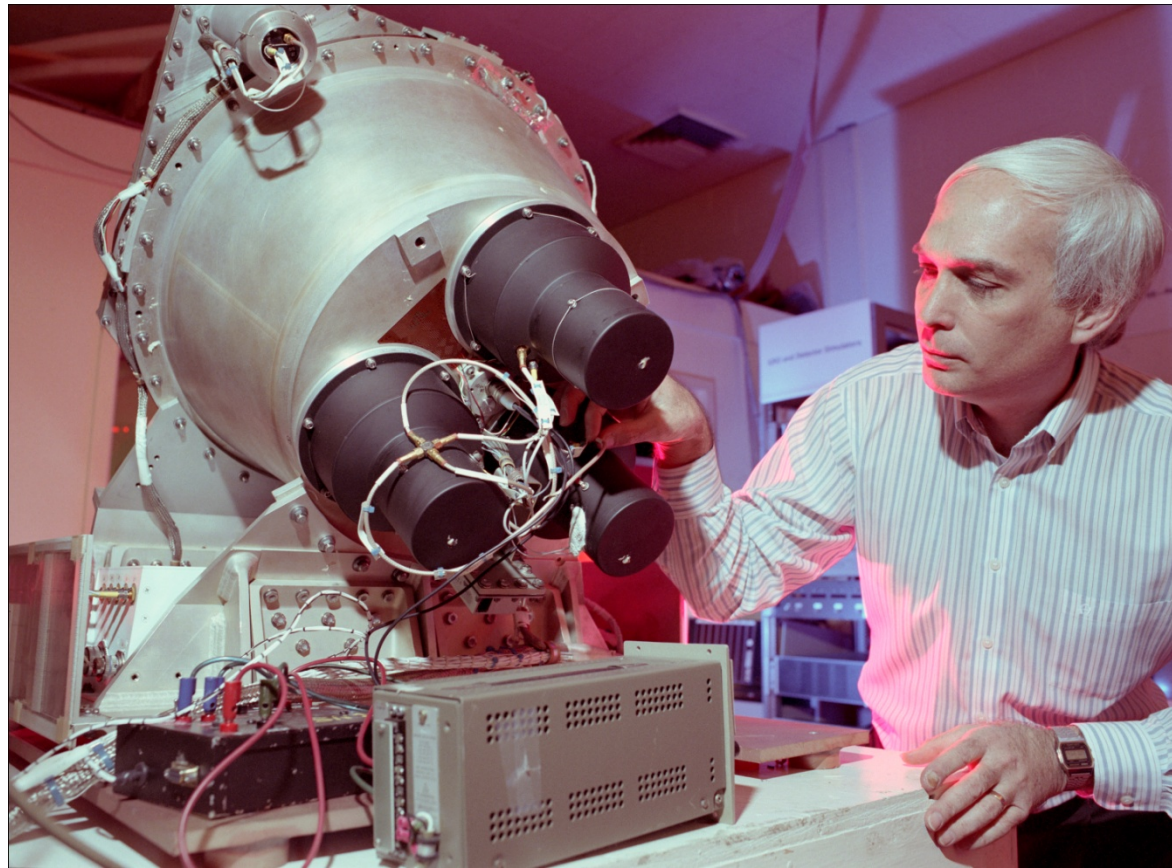




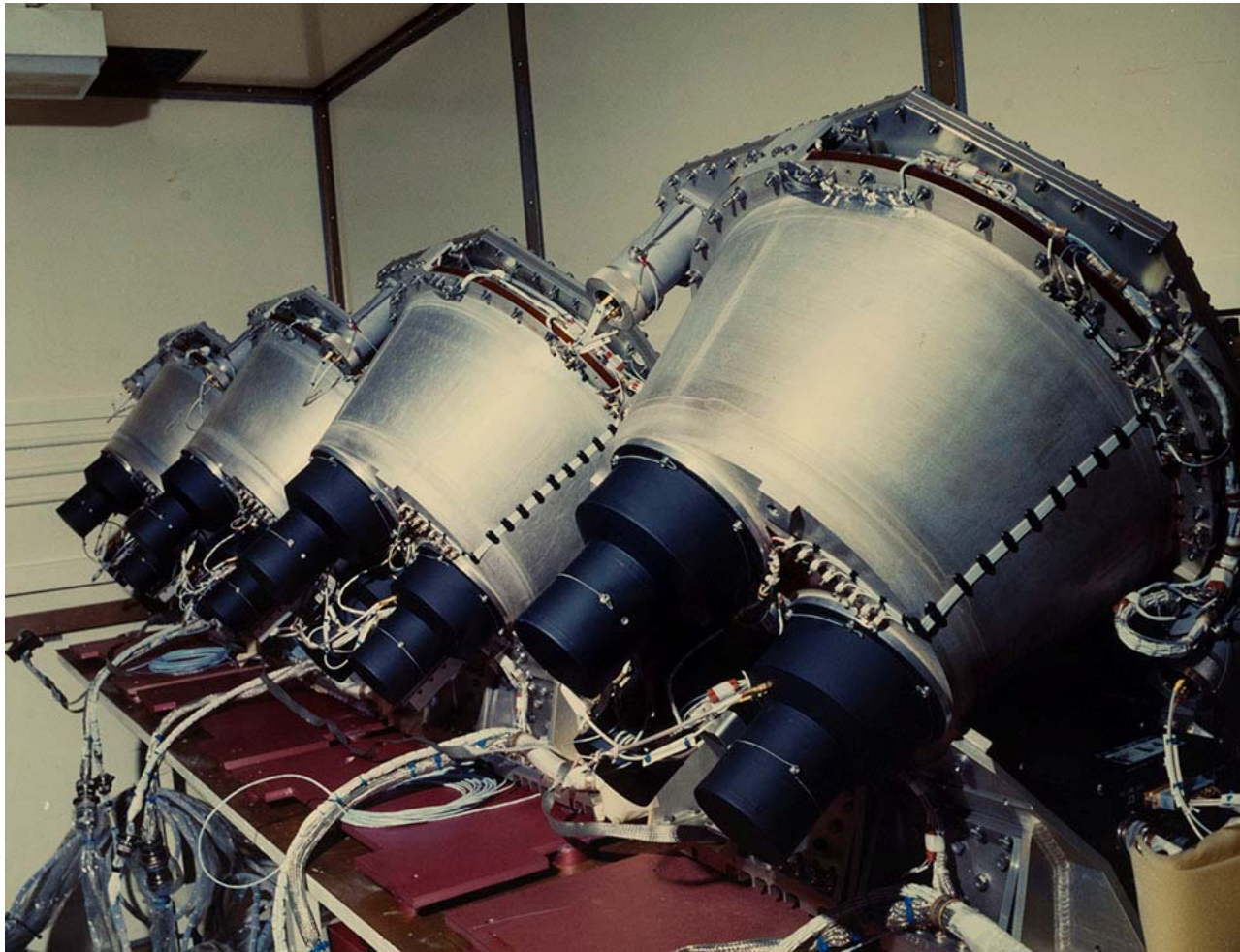
Building BATSE & GRO

1982 - 1989

BATSE Detector Module



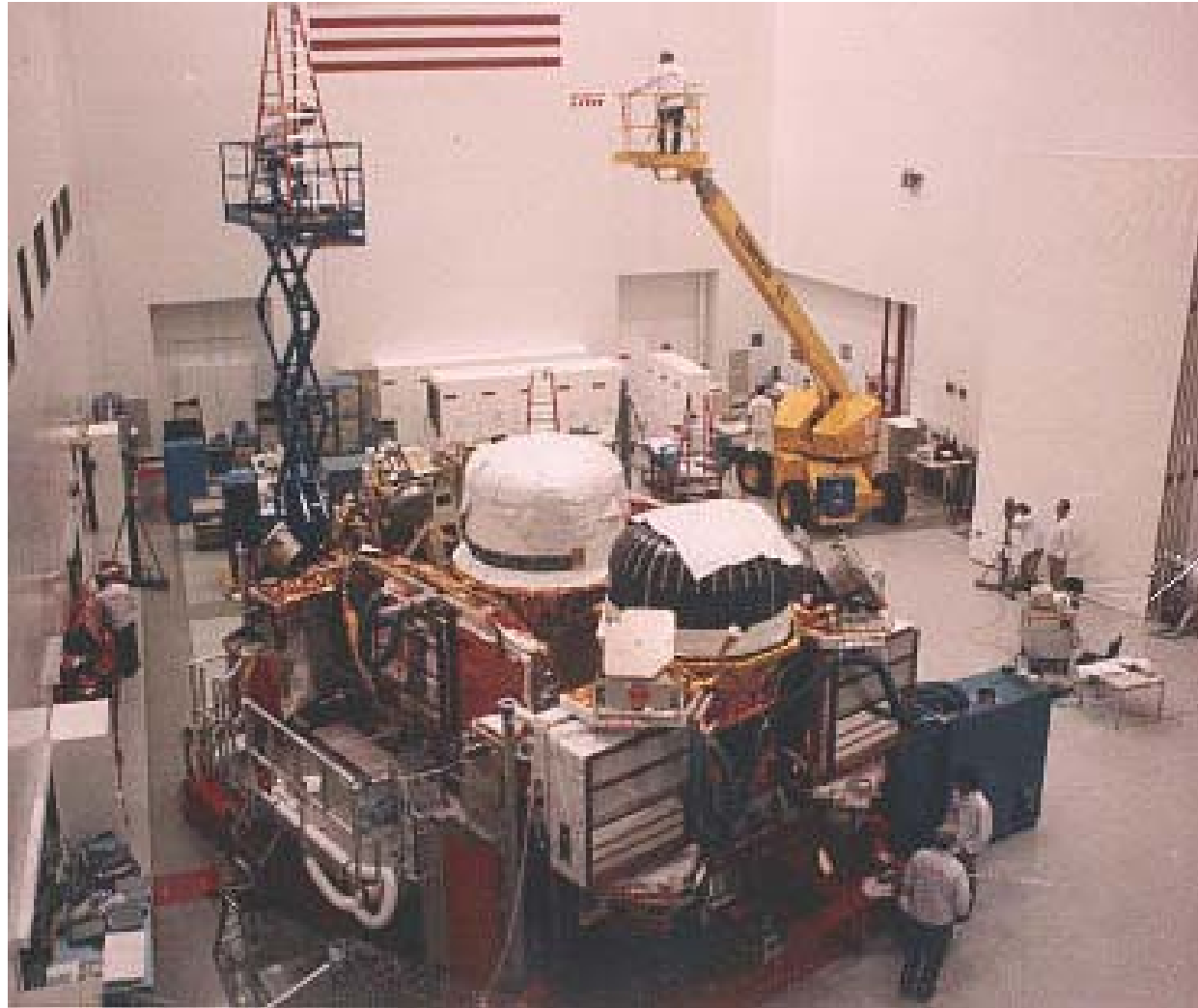
BATSE Detector Modules:
- Design, Fabrication, Testing & Calibration
at NASA-MSFC



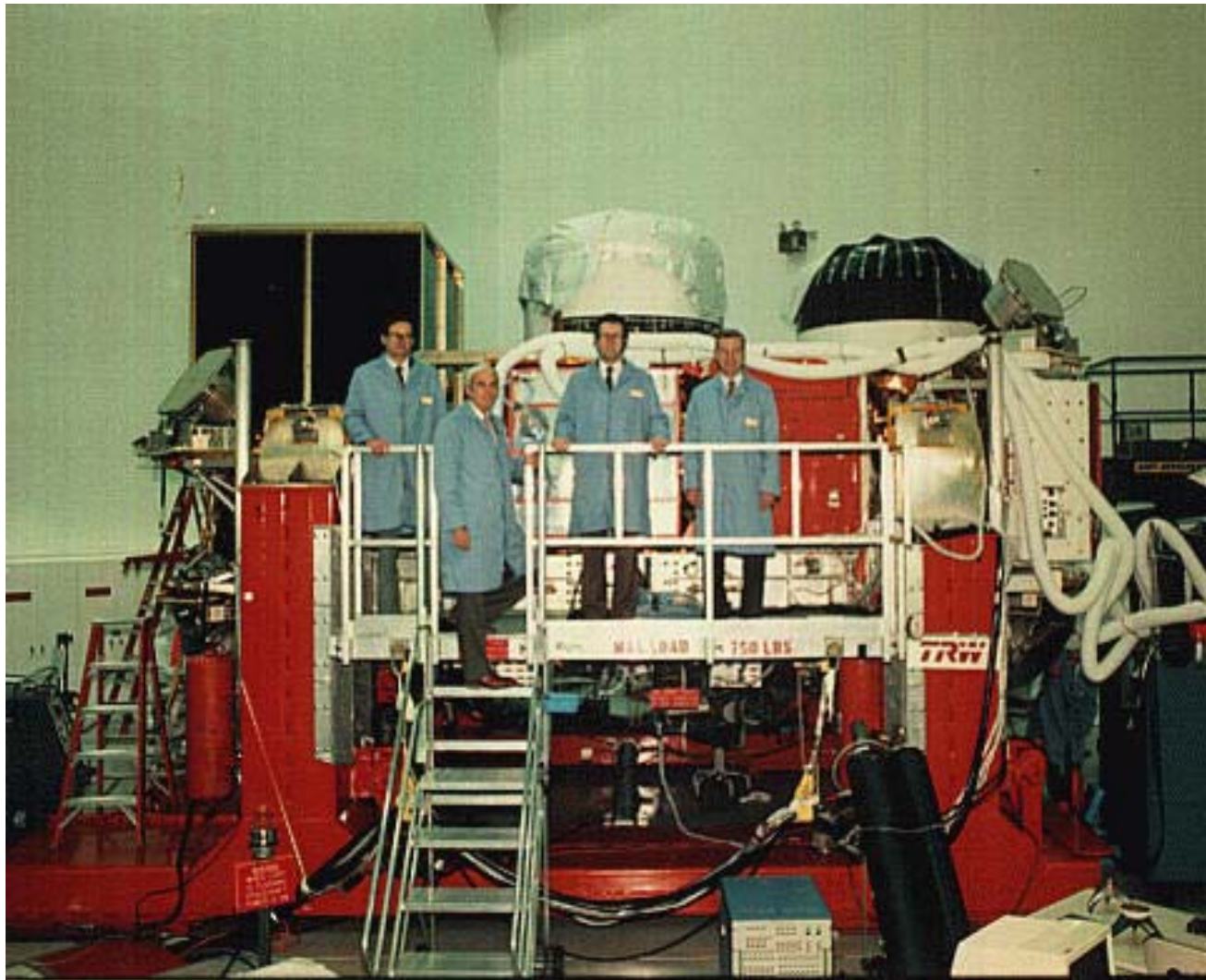
Integration of Experiments on GRO Spacecraft in California



Radioactive Source Survey of BATSE on the GRO Spacecraft in



GRO P.I.s Near the GRO Instruments



**Launching
&
Deploying GRO**

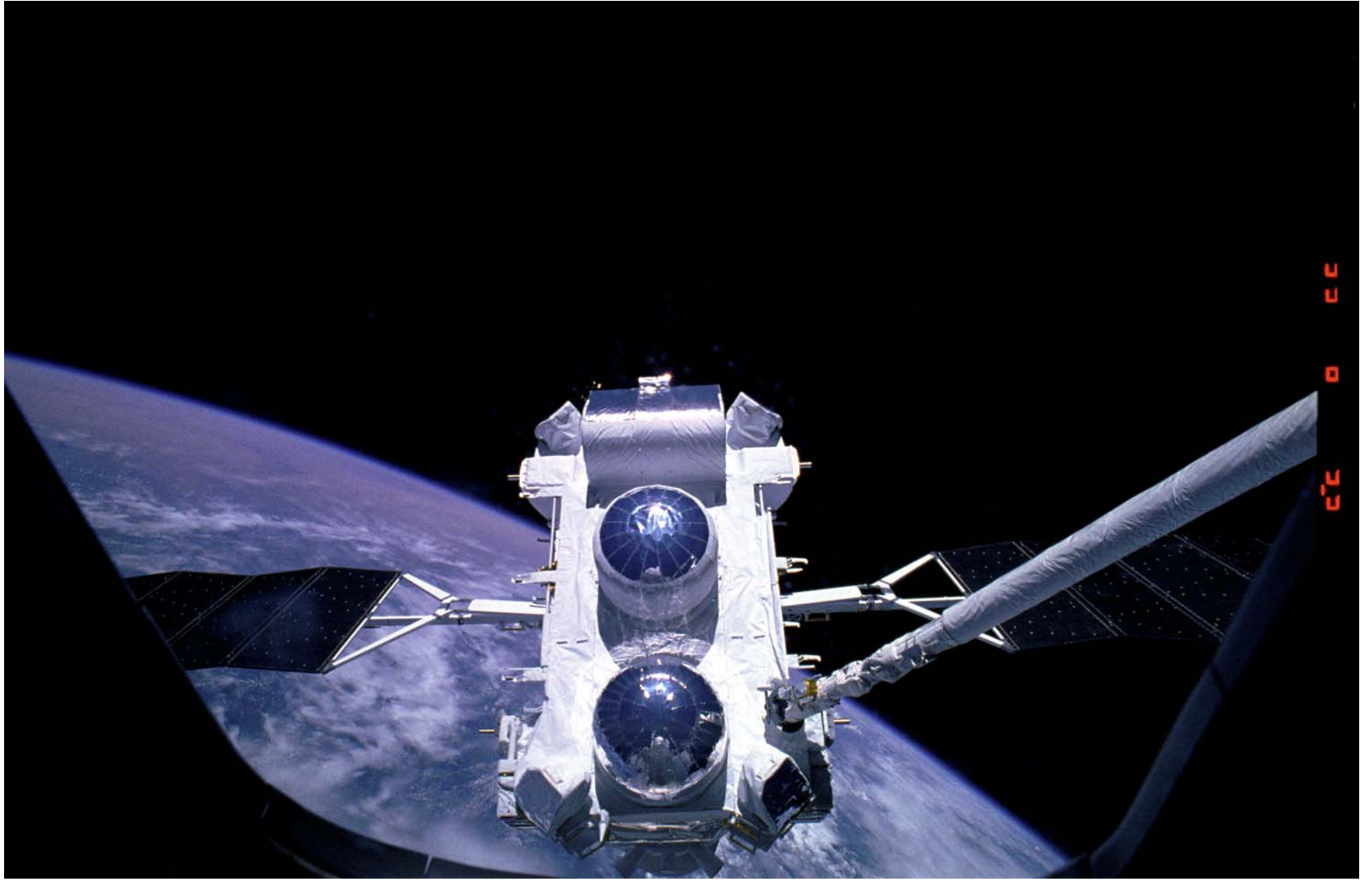
April 4-5, 1991

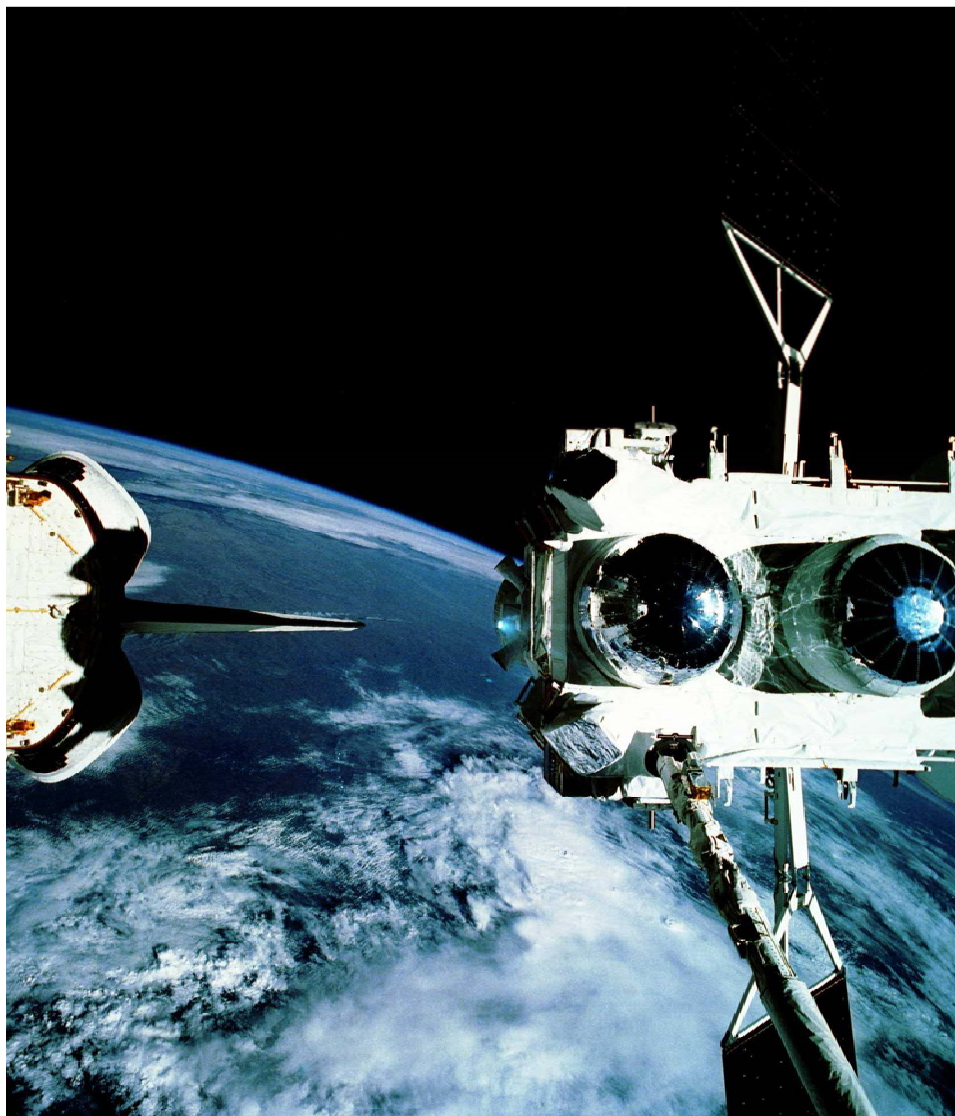
**Shuttle launch –
Gamma-Ray
Observatory (GRO)**

**(Operational:
re-named CGRO)**









nature

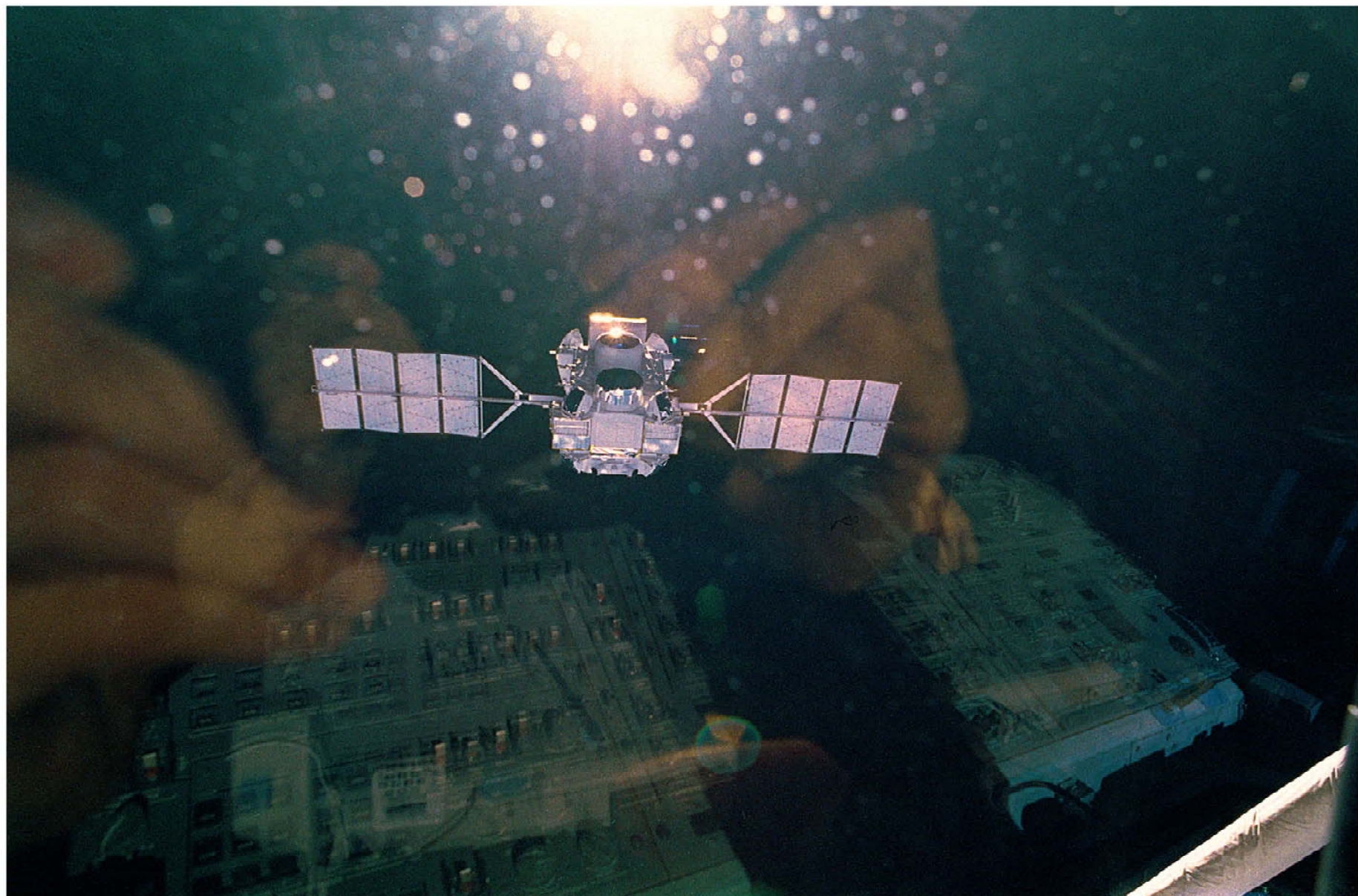
INTERNATIONAL WEEKLY JOURNAL OF SCIENCE

Volume 355 No. 6356 9 January 1992 \$7.75



MAPPING COSMIC GAMMA-RAY BURSTS

An inventory for the origins of life
More pulsar planets
Atomic structure of bacteriophage ϕ X174



BATSE

First large experiment designed for GRB studies:

- Full-sky
- Large area
- Good sensitivity for E_{peak} of most GRBs
- Moderate spectral capabilities – (good enough for most time/spectral correlations and time resolved spectral studies)

BATSE - Major GRB Results

- **Global properties of GRB Distributions:**
 - Intensity Distribution & Sky Distribution
 - Not consistent with any Galactic Distribution, nearby extragal objects, incl. large clusters
 - Strong Indications that GRBs were at cosmological distances (Although BeppoSAX nailed it)
- **Comprehensive Temporal/Spectral Studies**
- **Two Populations of GRBs**
- **Rapid GRB Response:** beginning of Bacosine/GCN - led to breakthrough wide-field observations (e.g. GRB990123)

BATSE Legacy

- Largest sample (2704); full-sky, 9+ years in operation
 - Well- characterized, full-sky instrument
 - Likely will not be exceeded for several decades
 - Led to GCN Network (S. Barthelmy)
- **Many Hundreds of Papers Based on BATSE Observations; >50 Ph.D. theses**

The End

Back-up Notes:

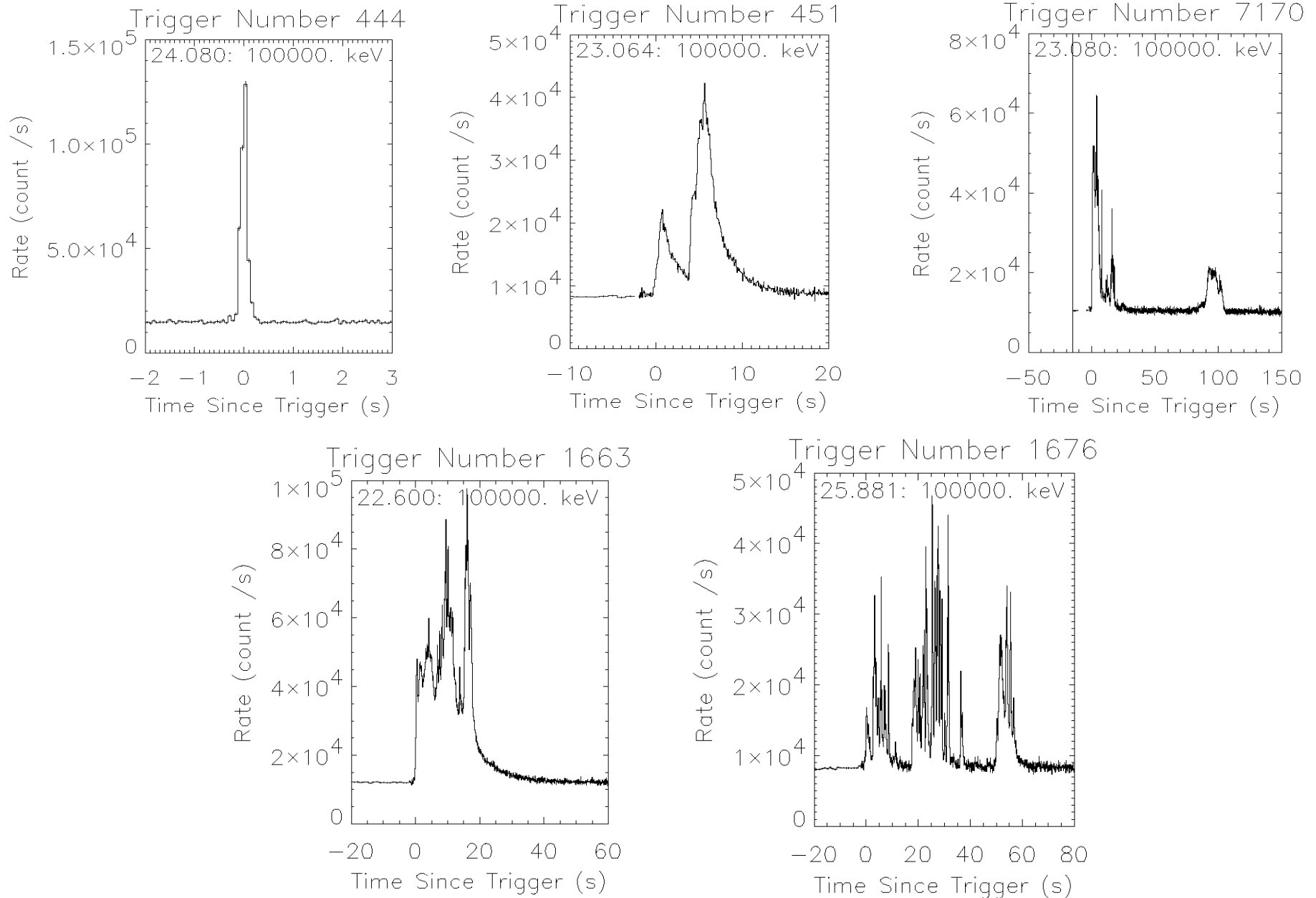
- First thoughts on GRB Observations:
 - Good field (nothing is known & high S/N)
- Need Large area to get many; remembered - $3/2$ power law: will give ~several GRBs/day
- Low-cost balloon flights others had same idea
- - propose for GRO (>>after Ltr. of Intent was due!

- Low cost; propose as signal to others.
- Propose dodecahedron (12) - 6 on top & 6 on bottom)
- Bottom was accepted; not the top, with 2 spares
- Fly the spares; need full sky w. same detectors; eight det. only (later a spare was approved

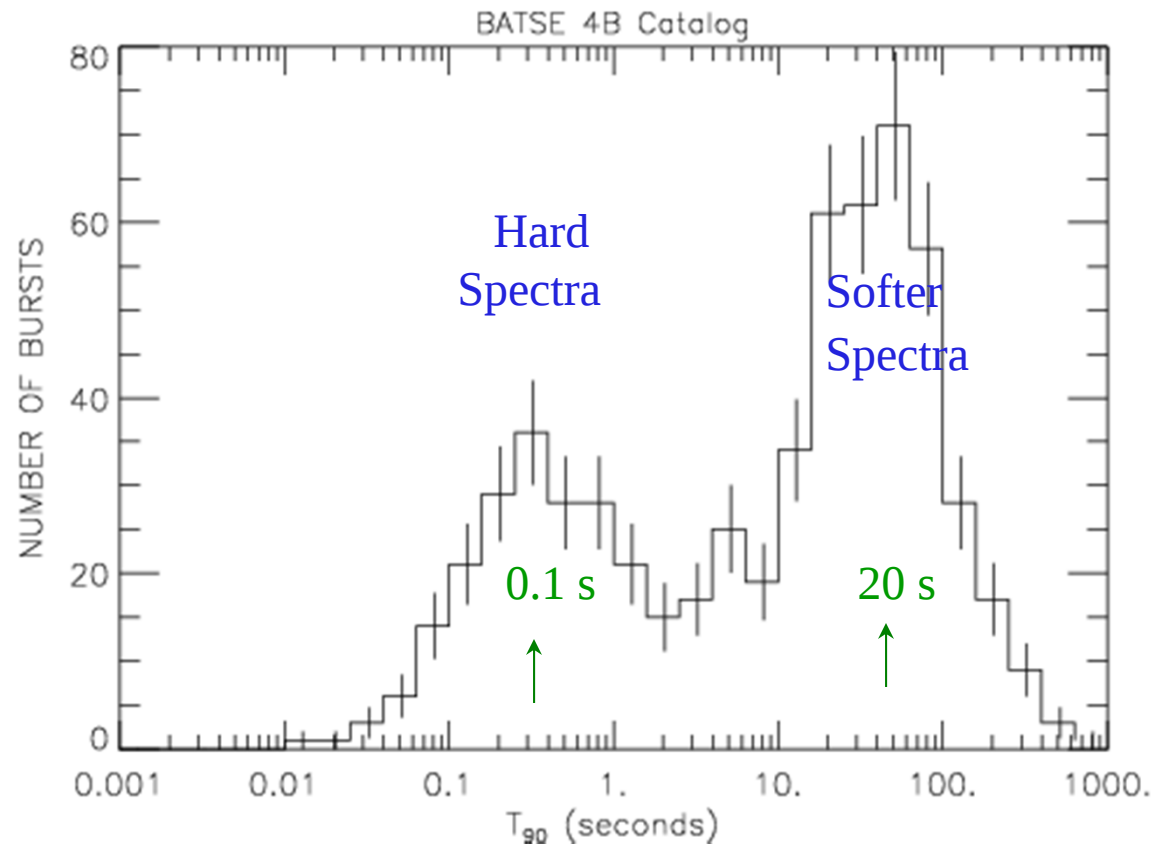
A Few Major BATSE GRB Results

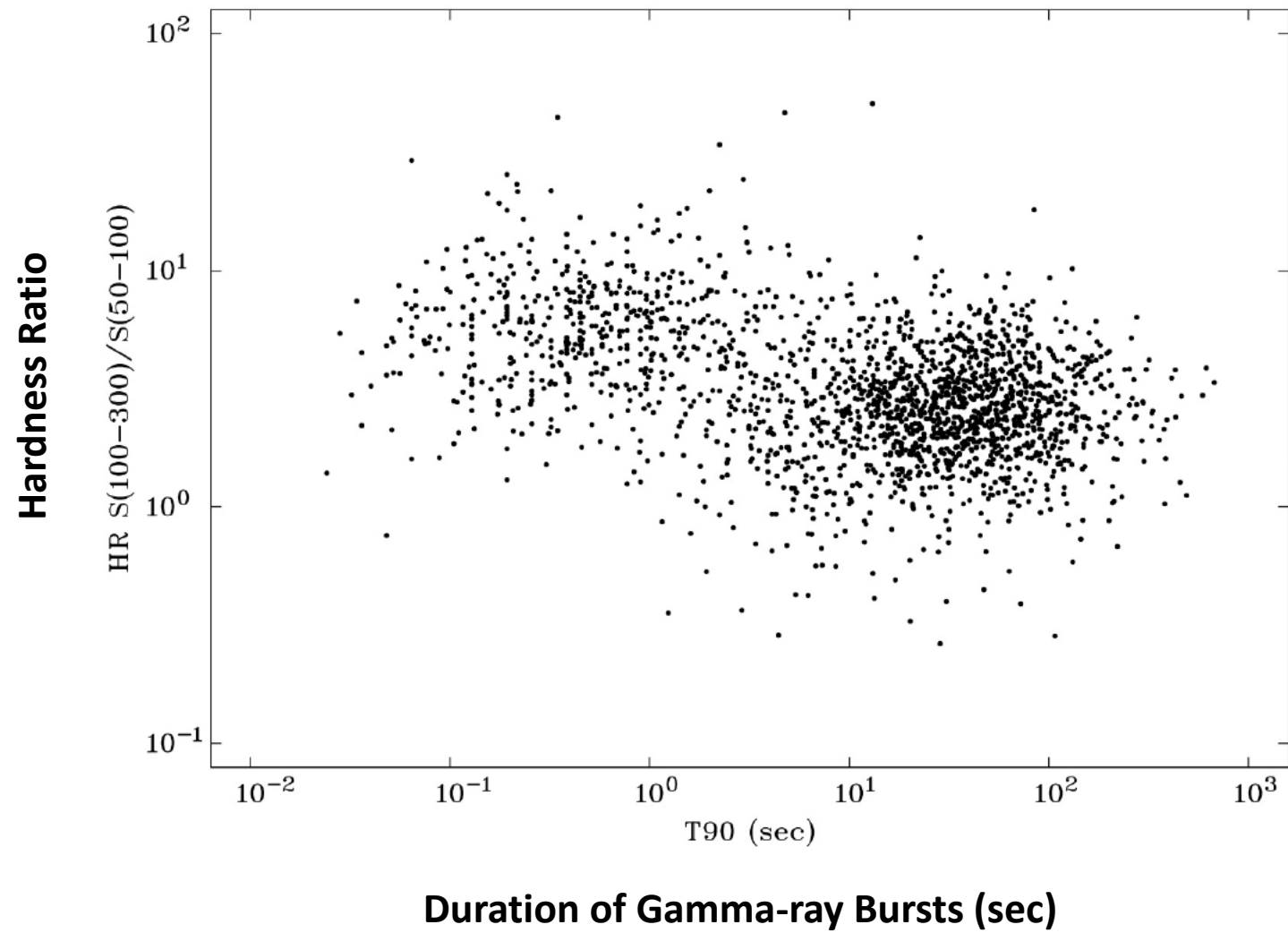
1991-2000

Diversity of GRB Profiles & Coupled Spectral / Temporal Properties

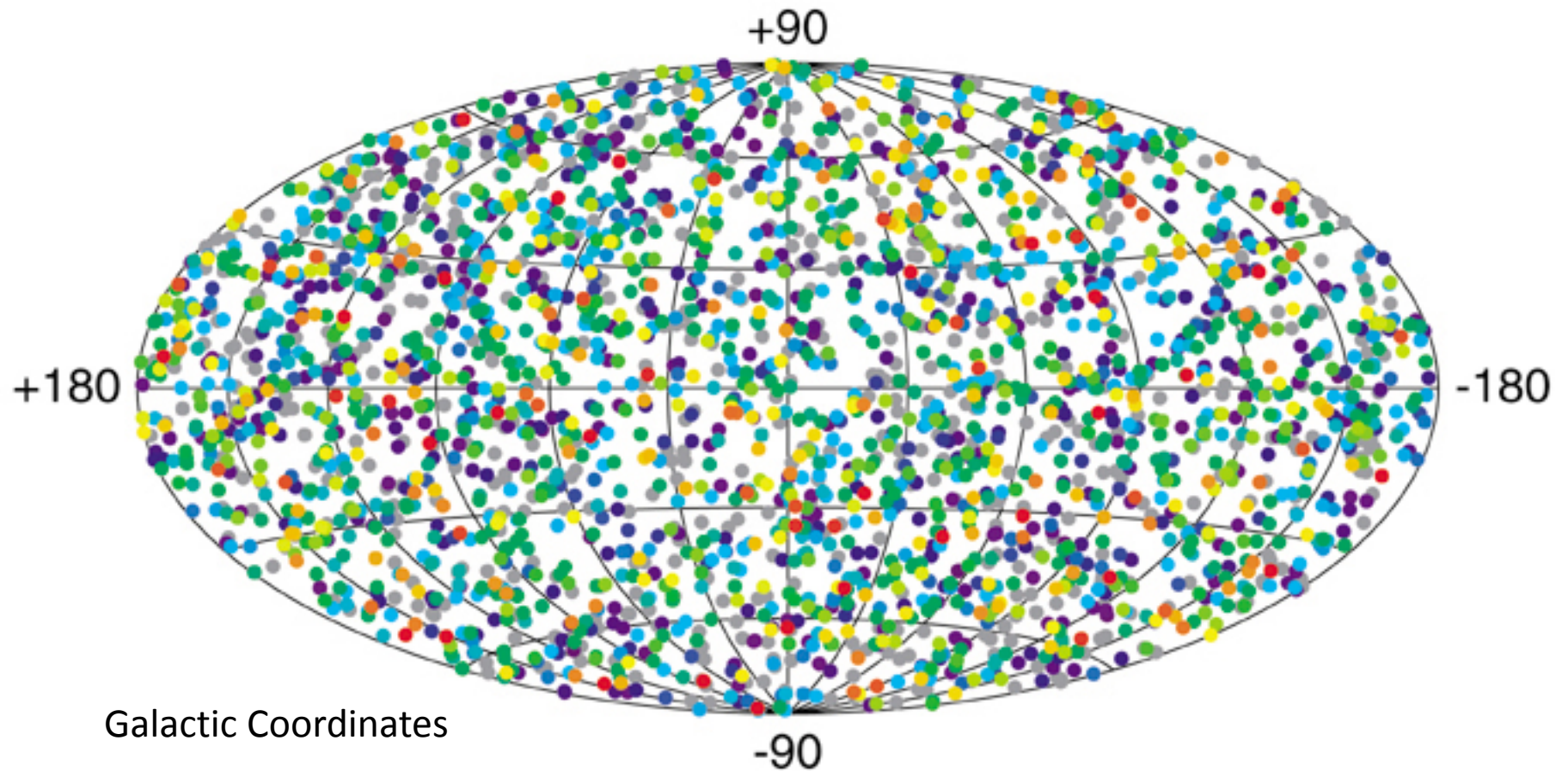


Two Distinct subclasses of γ -ray bursts: short/hard & long/soft

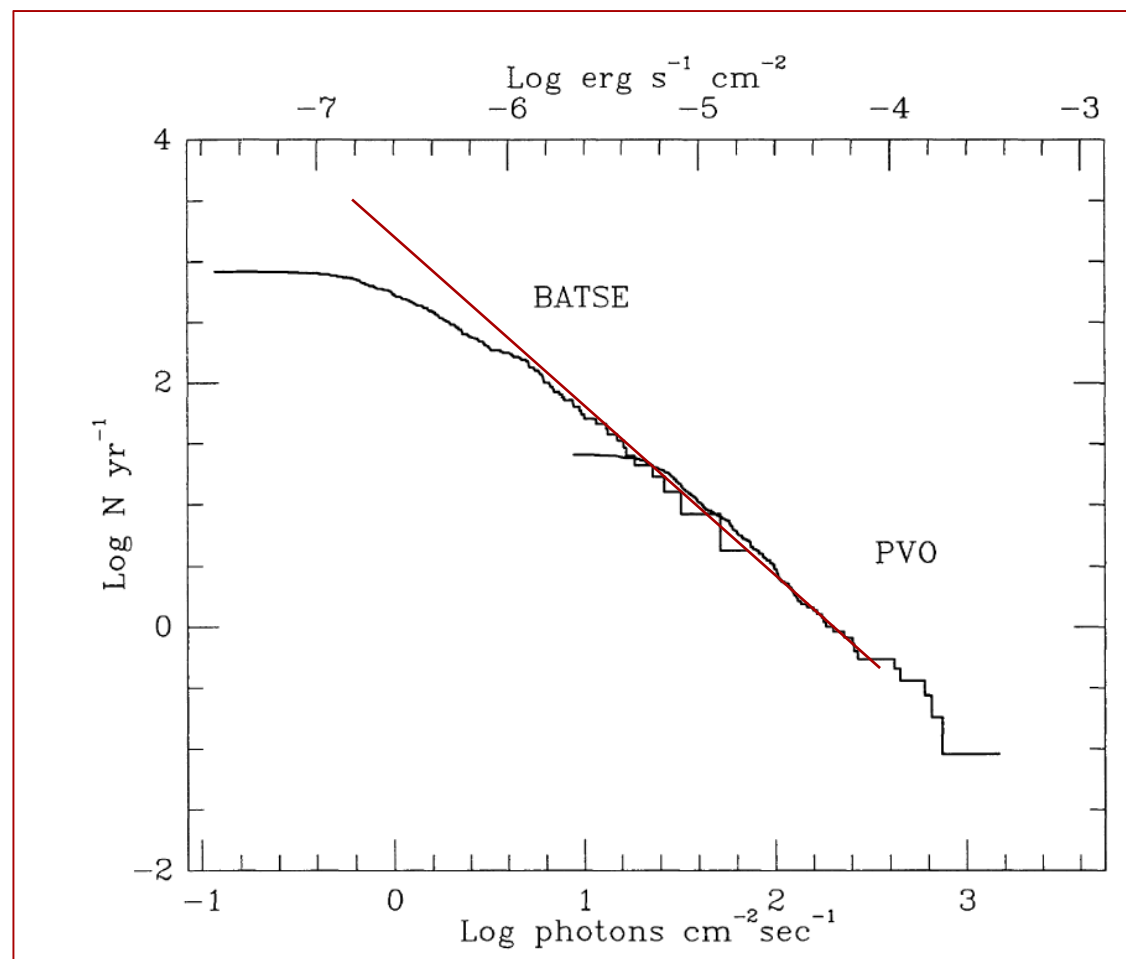


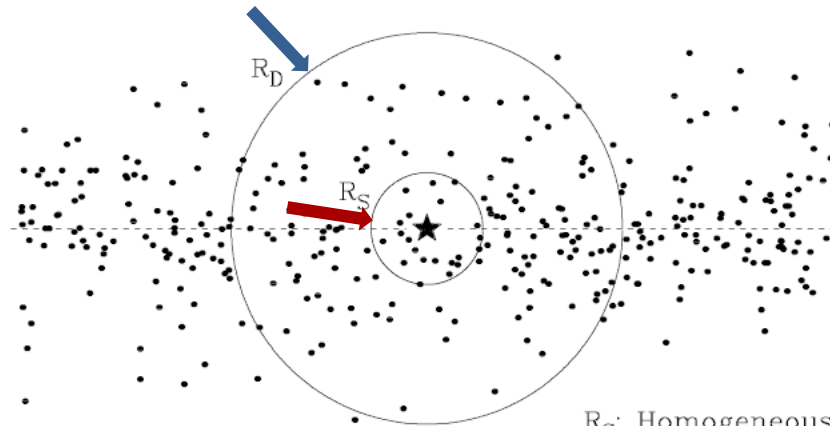


2704 BATSE Gamma-Ray Bursts

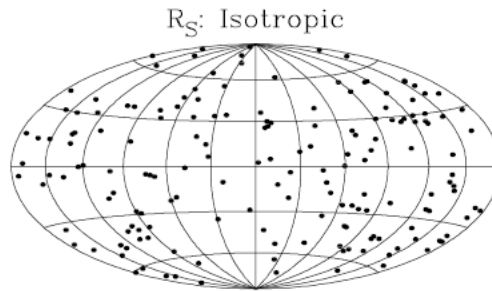


Apr. 1991 – May 2000



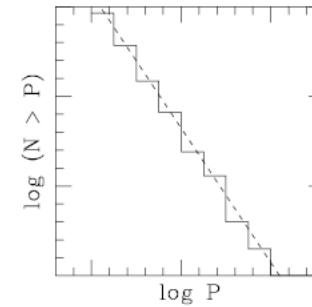


R_S - Galactic, Nearby

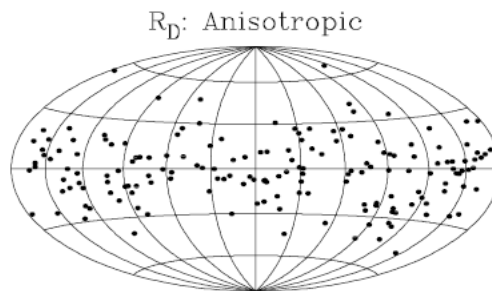


R_S : Isotropic

R_S : Homogeneous

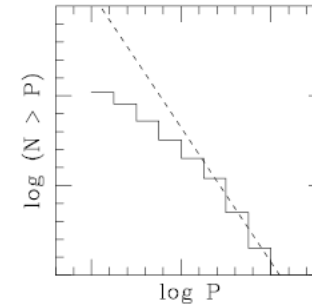


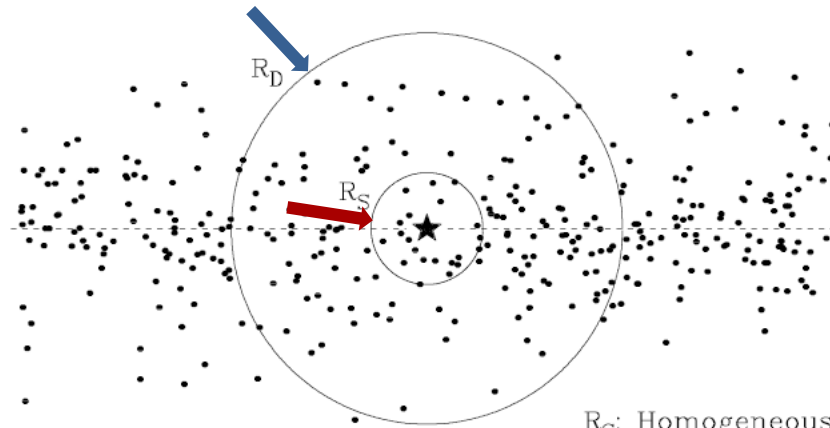
R_D - Galactic, Far away



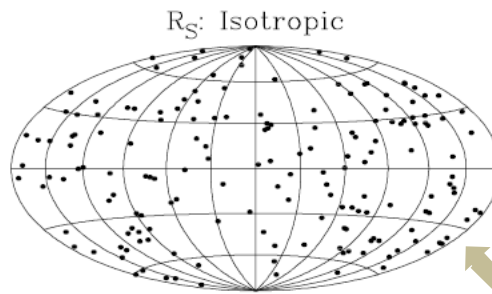
R_D : Anisotropic

R_D : Inhomogeneous

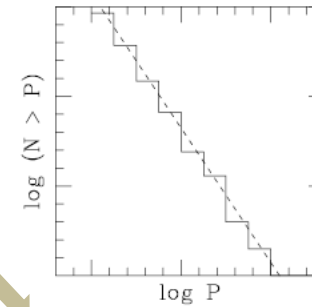




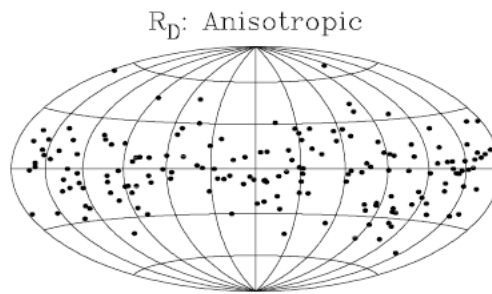
R_S - Galactic, Nearby



R_S : Homogeneous



R_D - Galactic, Far away



R_D : Inhomogeneous

